Single Photon Counting LIDAR Sensor, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

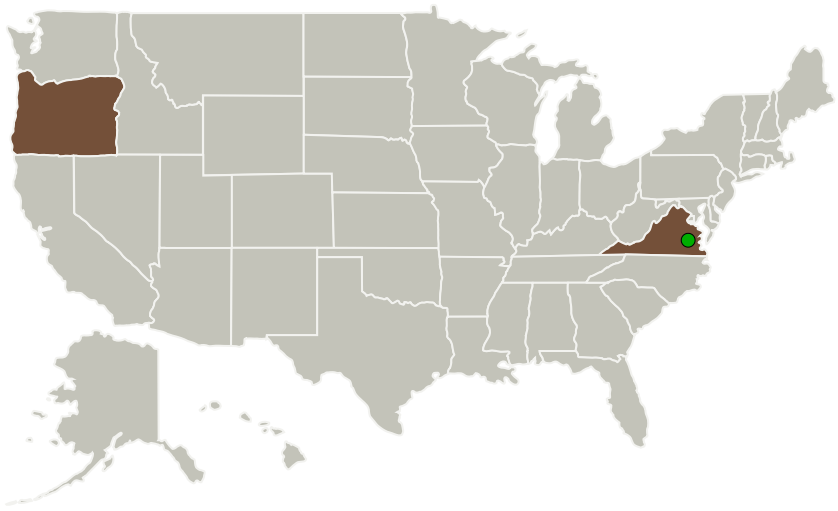
To address NASA's need for next-generation spaceborne lidar systems for aerosol, cloud, and ocean profiling, Voxtel is developing a low-noise high-efficiency high-dynamic-range photon-counting (HiP) sensor. The HiP sensor is based on silicon single-photon avalanche diode (SPAD) technology and is capable of both atmospheric and ocean profiling, essentially enabling the first-ever ocean-profiling lidar from space and advanced retrievals of dense cloud properties. The HiP sensor has a linear photon-counting dynamic range of 10 GHz, a low dark-count rate of 25 kHz, and a high photon-detection efficiency of 35% at 532 nm.

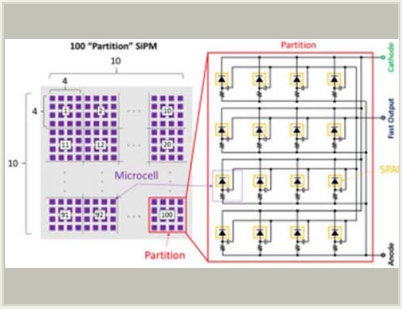
Anticipated Benefits

The HiP sensor will enable the first-ever ocean-profiling lidar from space and advanced retrievals of dense cloud properties, thus enabling missions such as the Decadal Survey for Earth Science and Applications from Space (ESAS) Aerosols-Clouds-Ecosystems (ACE), which requires a multi-wavelength high-spectral resolution lidar (HSRL) to provide vertically resolved profiling of clouds and aerosols in the atmosphere and optical properties in the ocean.

This technology is also broadly applicable to ground-, aircraft-, and space-based direct detection lidars operating in the 355 to 900-nm wavelength range, including differential-absorption lidars, for chemical and biologic threat detection, and direct-detection wind lidars. The sensor is also suited for the emerging lidar markets of automotive, drone and robotics.

Primary U.S. Work Locations and Key Partners





Single Photon Counting LIDAR Sensor, Phase I

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destination	3

Single Photon Counting LIDAR Sensor, Phase I

Completed Technology Project (2018 - 2019)

Organizations Performing Work	Role	Type	Location
Voxtel, Inc.	Lead Organization	Industry	Beaverton, Oregon
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Oregon	Virginia

Project Transitions

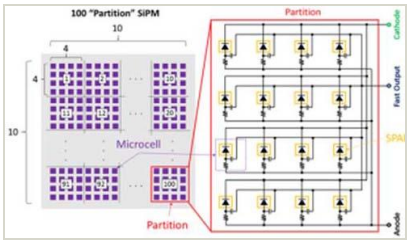
July 2018: Project Start

February 2019: Closed out

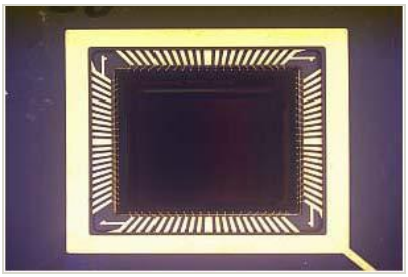
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141295)*

Images



Briefing Chart Image
Single Photon Counting LIDAR Sensor, Phase I
(https://techport.nasa.gov/image/134859)



Final Summary Chart Image
Single Photon Counting LIDAR Sensor, Phase I
(https://techport.nasa.gov/image/133589)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Voxtel, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Vinit Dhulla

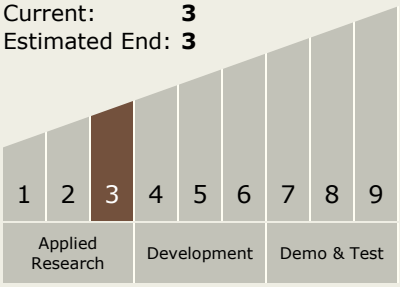
Co-Investigator:
Vinit Dhulla

Single Photon Counting LIDAR Sensor, Phase I

Completed Technology Project (2018 - 2019)

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destination

Earth